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Electrophoretic deposition of magnesium silicates on titanium implants: ion migration and silicide interfaces

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Abstract

Magnesium silicates (Mg_xSiO_y) and in particular forsterite (Mg_2SiO_4) owing to their low thermal expansion mismatch with metals are promising materials for bioactive coating of implants. Here, we report the electrophoretic deposition (EPD) of forsterite onto titanium substrates using different precursors. Unlike bulk samples which achieve full stoichiometry only beyond 1400°C, non-stoichiometric magnesium silicate rapidly decomposes into magnesium oxide nanowires during sintering. Elemental mapping and X-ray diffraction suggest that oxygen diffusion followed by ion exchange near the substrate leads to formation of an interfacial Ti_5Si_3 layer. Pre-annealed forsterite powder on the other hand shows a comparatively lower diffusion rate.